

#### ABSTRACT OF THE DISCLOSURE

A multi-channel, reconfigurable fiber-coupled Raman instrument uses fiber optic switches for laser and calibration light routing to facilitate automated calibration, diagnosis and operational safety. The system allows wavelength axis calibration on all channels; laser wavelength calibration (including multiple and/or backup laser options);  
5 fiber coupling optimization; fault detection/diagnosis; and CCD camera binning setup. In the preferred embodiment, dedicated calibration channels surround data channels on a 2-dimensional CCD dispersed slit image implemented using a unique cabling architecture. This “over/under” calibration interpolation approach facilitates quasi-simultaneous or sequential calibration/data acquisitions. CCD binning between sequential calibration and  
10 data acquisitions enables higher density multi-channel operation with tilted images based upon a multiplexed grating configuration. A diamond sample is used as a Raman shift reference for laser calibration, preferably in the form of a small disc sampled with an edge-illuminating probe using two unfiltered fibers. Detection of beam transmitted through the diamond reference is also used to optimize laser coupling efficiency with  
15 motion servos. An “intrinsically safe” laser interlock circuit also serves as current source for probe head “laser on” diode indicator. The integrity of key components is monitored through strategically placed photodiodes positioned, for example, at fiber bends to detect light leakage from bent fiber as verification of commanded laser path through fiber switches and at neon and halogen lamp locations to verify lamp operation. The optical  
20 switches used for calibration may also be configured for use as a laser shutter.